Entergy Nuclear Operations, Inc.
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Anthony J. Vitale
Site Vice President

PNP 2011-073

November 21, 2011

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

SUBJECT: Licensee Event Report 2011-007, Direct Current Electrical System Fault Causes Reactor Trip and Multiple Safety System Actuations

Palisades Nuclear Plant
Docket 50-255
License No. DPR-20

Dear Sir or Madam:

Licensee Event Report (LER) 2011-007 is enclosed. This LER describes a direct current electrical system fault that caused a reactor trip and multiple safety system actuations. In addition, an unanalyzed condition was discovered due to non-compliance with 10 CFR 50 Appendix R. These conditions are reportable in accordance with 10 CFR 50.73(a)(2)(iv)(A) and 10 CFR 50.73(a)(2)(ii)(B).

This letter contains no new commitments and no revisions to existing commitments.

Sincerely,

ajv/tad

Attachment: LER 2011-007, Direct Current Electrical System Fault Causes Reactor Trip and Multiple Safety System Actuations

CC Administrator, Region III, USNRC
Project Manager, Palisades, USNRC
Resident Inspector, Palisades, USNRC

ATTACHMENT

LER 2011-007

DIRECT CURRENT ELECTRICAL SYSTEM FAULT CAUSES REACTOR TRIP AND MULTIPLE SAFETY SYSTEM ACTUATIONS

3 Pages Follow

NRC FORM 366
U.S. NUCLEAR REGULATORY COMMISSION
(10-2010)

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

APPROVED BY OMB NO. 3150-0104 EXPIRES 10/31/2013

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4. TITLE

Direct Current Electrical System Fault Causes Reactor Trip and Multiple Safety System Actuations

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
09	25	2011	2011	- 007 -	00	11	21	2011	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE

1

10. POWER LEVEL

98

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☒ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER Specify in Abstract below or in NRC Form 366A
☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER (Include Area Code)
Terry Davis	(269) 764-2117

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
B	EJ	BKR	G190	Y					

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES (If yes, complete 15. EXPECTED SUBMISSION DATE) ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On September 25, 2011, at 1506 hours, during planned maintenance activities on a direct current (DC) electrical distribution (ED) panel, ED-11-2, a short circuit fault between the positive and negative bus bars was introduced into the system. The fault was caused by the accidental contact between bus bar connectors within the panel. Subsequently, a partial loss of DC electrical system power occurred, causing an automatic reactor trip and multiple safety system actuations.

The fault from ED-11-2 propagated upstream, resulting in a loss of left train DC power to two-of-four inverters and subsequent loss of alternating current (AC) power from the inverters to two-of-four preferred busses. The loss of power initiated a reactor trip via the automatic actuation of the reactor protection system (RPS). Additional automatic actuations include the closure of the main steam isolation valves (MSIVs), actuation of the safety injection system (SIS), actuation of the containment isolation system (CIS), and actuation of the auxiliary feedwater system (AFS). The MSIVs, RPS, SIS, CIS and AFS performed as designed for the loss of power condition.

The root cause of the event was attributed to risk management processes not being followed, resulting in the failure to adequately manage the risk associated with the maintenance on the ED-11-2 panel. In addition, there was insufficient breaker and fuse coordination for the left train of the 125 volt DC system. An engineering change was approved and installed to reduce the probability of recurrence. Repairs to the affected DC electrical system components were completed and the reactor was returned to full power operation on October 3, 2011.

EVENT DESCRIPTION

On September 25, 2011, at 1506 hours, with the plant in Mode 1 at approximately 98% power, during planned maintenance activities on a direct current (DC) electrical distribution (ED) [EJ] panel, ED-11-2, a short circuit fault between the positive and negative bus bars was introduced into the system. The fault was caused by the accidental contact between bus bar connectors within the panel.

The fault from ED-11-2 propagated upstream, resulting in a loss of DC power from the associated DC bus to two-of-four inverters. The loss of DC power to two-of-four inverters caused a loss of alternating current (AC) power from the inverters to two-of-four preferred busses. The loss of power initiated a reactor trip via the automatic actuation of the reactor protection system (RPS). Additional automatic actuations include the closure of the main steam isolation valves (MSIVs), actuation of the safety injection system (SIS), actuation of the containment isolation system (CIS), and actuation of the auxiliary feedwater system (AFS). The MSIVs, RPS, SIS, CIS and AFS performed as designed for the loss of power condition.

There were no inoperable structures, systems, or components at the start of this event that contributed to the event.

The event is reportable in accordance with 10 CFR 50.73(a)(2)(iv)(A) as an event that resulted in the actuation of multiple safety systems and 10 CFR 50.73(a)(2)(ii)(B) as an unanalyzed condition due to non-compliance with 10 CFR 50 Appendix R.

CAUSE OF THE EVENT

The root cause of the event was attributed to risk management processes not being followed, resulting in the failure to adequately manage the risk associated with the maintenance on the ED-11-2 panel. In addition, there was insufficient breaker and fuse coordination for the left train of the 125 volt DC system.

The 125 volt DC system is divided into two independent and isolated systems, left train and right train. In 1981, a circuit breaker [BKR] with a shunt trip device was installed in each independent train. The shunt trip device is a trip coil that, when energized, allows opening of the breaker remotely. The purpose of the breaker is to prevent battery drain from ground faults in the DC system due to fires in the plant's cable spreading room.

The breakers, 72-01 in the DC system left train and 72-02 in the DC system right train, were designed to be non-automatic, manually operated, with the capability of being opened remotely via the shunt trip device. Per the site's licensing basis documentation, the breakers were not intended to interrupt fault currents, although they have that capability. Contrary to the site's design and licensing basis documentation, the breakers contained an automatic trip feature that caused breaker 72-01 to trip open due to the over-current produced from the short circuit condition on September 25, 2011.

The as-found automatic trip set-point of shunt trip breaker 72-01 was too low to demonstrate acceptable 10 CFR 50, Appendix R, electrical coordination. The automatic trip set-point of shunt trip breaker 72-02 was found at the maximum value. It was determined that the maximum value, for the breaker's automatic trip set-point, is acceptable for 10 CFR 50, Appendix R, electrical coordination.

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CORRECTIVE ACTIONS TAKEN

In response to the event, an Entergy corporate event response team (CERT) was dispatched to Palisades to independently review the causes and contributors to the event with a special focus on the organizational and programmatic aspects. Based on the findings identified by the CERT, Palisades has implemented a site recovery plan to correct significant behavior and performance gaps at all levels of the organization.

The damaged bus bar connectors in the ED-11-2 panel were replaced.

Guidance for work on energized circuits was issued to assist in the identification of situations that could result in an industrial safety risk activity or a potential plant shutdown.

To reduce the probability of recurrence, an engineering change was approved and installed raising the automatic trip set-point of shunt trip breaker, 72-01, to the maximum value and allowed shunt trip breaker, 72-02, to remain at the maximum value. Compensatory measures were implemented that administratively prevents work from being performed on the affected DC electrical distribution panels, and cables within the cable spreading room connected to the affected DC electrical distribution panels, when the associated DC bus is required to be operable. Additional compensatory measures were implemented that allow only one battery charger to be connected an operable DC bus and the opening of breakers in the affected DC electrical distribution panels that supply power to non-safety related loads.

CORRECTIVE ACTIONS TO BE TAKEN

A training needs analysis will be performed to determine the appropriate performance improvement intervention to be implemented that will ensure risk management processes are adequately incorporated into the work planning process and risk is appropriately managed.

An engineering change will be implemented to permanently correct the coordination issues with shunt breakers and their respective DC system electrical distribution panel fuses.

ASSESSMENT OF SAFETY CONSEQUENCES

No actual safety consequences resulted from this event. System response was as expected given a loss of one train of DC power. The SIS operated but did not inject since primary coolant system pressure remained above shutoff head. The right train of DC power remained available throughout the event. The occurrence of the short circuit fault in the DC panel and actuation of the over-current trip of the shunt breaker represents the worst consequence for failure of one train of DC power.

PREVIOUS SIMILAR EVENTS

None